Building Community Resilience – Learning from the 2011 Floods in Southeast Queensland, Australia

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The year 2010 was the wettest year on record for Queensland, Australia and the wettest year since 1974 for Southeast Queensland. The extremely heavy rain in early January 2011 fell on the catchments of heavily saturated Brisbane and Stanley Rivers systems resulting in significant runoff which rapidly produced a widespread and devastating flood event. The area of inundation was equivalent to the total land area of France and Germany combined. Over 200,000 people were affected leaving 35 people dead and 9 missing. The damage bill was estimated at over $1B and cost to the economy at over $10B with over 30,000 homes and 6,000 business flooded and 86 towns and regional centres affected.

The need to disburse disaster funding in a prompt manner to the affected population was paramount to facilitate individuals getting their lives back to some normality. However, the payout of insurance claims has proved to be a major area of community anger. The ongoing impasse in payment of insurance compensation is attributed to the nature and number of claims, confusing definition of flooding and the lack or accuracy of information needed to determine individually the properties affected and legitimacy of claims. Information was not readily available at the micro-level including, extent and type of inundation, flood heights at property level and cause of damage. Events during the aftermath highlighted widespread community misconceptions concerning the technical factors associated with the flood event and the impact of such on access to legitimate compensation and assistance. Individual and community wide concerns and frustration, anger and depression, have arisen resulting from delays in the timely settlement of insurance claims. Lessons learnt during the aftermath are presented in the context of their importance as a basis for inculcating communities impacted by the flood event with resilience for the future.

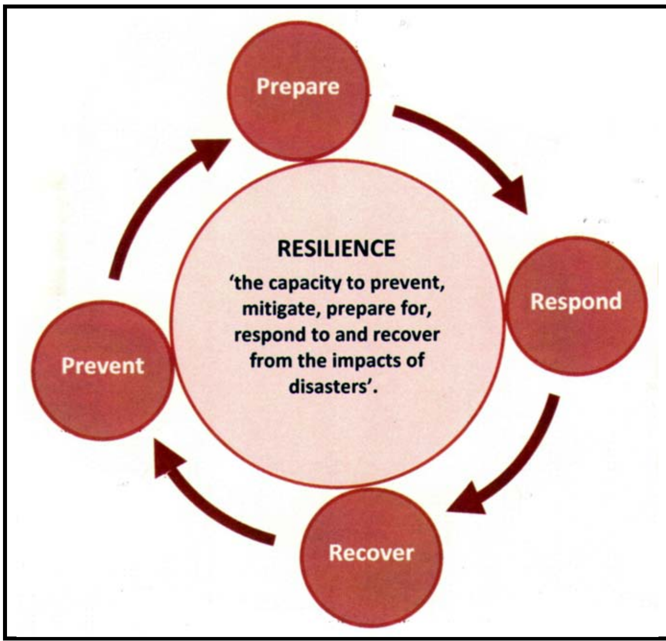
Key Words: *flood, inundation, damage, insurance, Queensland, community resilience*

1. INTRODUCTION

The reconstruction and recovery activities necessitated by the devastating flood and weather events of the summer of 2010-11 have presented a unique opportunity to re-build a stronger and more resilient Queensland by enhancing the resilience of the community, the economy and the environment. The Queensland Reconstruction Authority (QRA), established on 21 February 2011, operates under a comprehensive and integrated recovery and reconstruction plan for the State – *Operation Queenslander: The State Community, Economic and Environmental Recovery and Reconstruction Plan 2011-2013*. The mission of QRA is to 'reconnect, rebuild and improve Queensland, its communities and economy'. This is supported by four strategic objectives, two of which specifically focus on resilience:

- build a resilient Queensland and support resilient Queenslanders; and
- enhance preparedness and disaster mitigation.[1)]

Disaster resilience has been defined as, 'the capacity to prevent, mitigate, prepare for, respond to, and recover from the impacts of disasters' (Figure 1).[2)]



Prevent: The taking of preventative measures to reduce the likelihood of an event occurring or, if an event occurs, to reduce the severity of the event.
Prepare: The taking of preparatory measures to ensure that, if an event occurs, communities, resources and services are able to cope with the effects of the event.
Respond:
The taking of appropriate measures to respond to an event, including action taken and measures planned in anticipation of, during and immediately after an event to ensure that the effects are minimised and that persons affected by the event are given immediate relief and support.
Recover: The taking of appropriate measures to recover from an event, including the action taken to support disaster-affected communities in the reconstruction of infrastructure, the restoration of emotional, social, economic and physical wellbeing and the restoration of the environment.
(State Disaster Management Group, Queensland State Disaster Management Plan, 2011)

Figure 1: Resilience in the disaster management cycle[3)]

Building resilience enhances our ability to minimise the effects of future disaster events on our communities, economy and environment. Building disaster resilience for the community is planning ahead to reduce disaster risks and produce co-ordinated and effective efforts during disaster events. Betterment is the enhancement of the resilience of a resource through a significant improvement or step change in the nature of that resource.[4)] The *Natural Disaster Relief and Recovery Arrangements Determination 2011* describes betterment as the repair or replacement of an asset, usually buildings or roads, to 'a more disaster resilient standard than its pre-disaster standard'.[5)]

In 2001, spatial datasets similar to the datasets provided by the Department of Environment and Resource Management (DERM) during the 2010-11 flood and weather events, were accorded the status of a 'soft' spatial infrastructure by the Commonwealth in the Spatial Information Industry Action Agenda.[6)] This paper will describe how spatial datasets and spatial information were utilised as an infrastructure by emergency management organizations in preparation for, during and in the aftermath of the Brisbane flood event. The shortcomings in the resilience of existent spatial information for flood response is identified as will the potential for its betterment as an infrastructure and driver for the betterment of community resilience in the face of future flood and other disaster events.

2. SETTING THE SCENE

The year 2010 was the wettest year on record for Queensland State, Australia and the wettest year since 1974 for Southeast Queensland. The extremely heavy rain in early January 2011 fell on the catchments of heavily saturated Brisbane and Stanley Rivers systems resulting in significant runoff which rapidly produced a widespread and devastating flood event. The area of inundation was equivalent to the total land area of France and Germany combined. Over 200,000 people were affected leaving 35 people dead and 9 missing. The damage bill is estimated at over $1B and cost to the economy at over $10B with over 30,000 homes and 6,000 business flooded and 86 towns and regional centres affected. Figure 2 depicts the modeling of the extent of predicted inundation along the floodplain of the Brisbane and Stanley River System.[7)]

(1) Wivenhoe Dam and false sense of security

Wivenhoe Dam was built as a response to the 1974 Brisbane floods. When it was completed in 1984, the hope was that floods of that magnitude might never happen again. It was believed that the dam would hold back the water. During the decade-long drought at the beginning of the millennium, Queensland's focus changed from flood mitigation to water security. Wivenhoe has a flood mitigation capacity of 710,000 Olympic-size swimming pools. The capacity of drinking water is the worth of 580,000 Olympic pools.[8)]

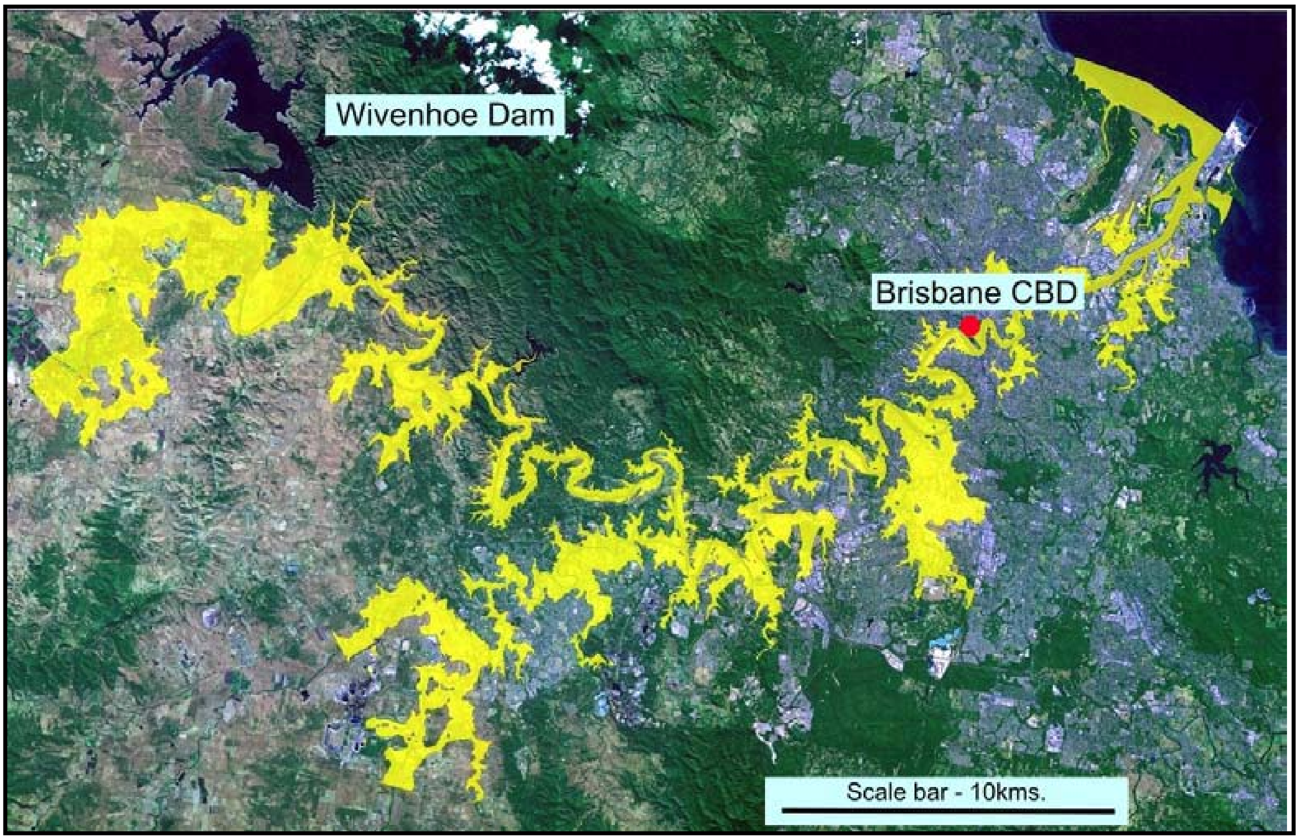


Figure 2: Flood modeling data (in yellow)

The time lapse of over 35 years following the 1974 Brisbane flood event resulted in a significant dimunition of the corporate knowledge held collectively by the community with respect to that earlier event.A series of floodplain maps prepared post 1974 primarly for development control purposes were available leading up to the 2011 flood event. The series titled, Brisbane River Inundation series at a scale of 1:10,000, and a second series, titled the 1974 Flood series at a scale of 1:31,680 had been compiled by interpolation from observations taken at a limited set of control points of the likely inundation extent. Both series provide only a generalised indication to the potential flood levels in an individual property.[9)]

(2) Urbanisation compared to 1974

Significant urbanisation has occurred in the Lower Brisbane River Catchment since the 1974 flood event, but the total urbanisation in the catchment is relatively small. Urbanisation can be neglected when assessing flood risk on large rivers, but it is important when assessing flooding on small creeks and tributaries.[10)]

The 1974 flood mainly affected the greater Brisbane area, with around 3% of dwellings, or 8,500 homes, inundated. The 2011 flood event affected 4.1% of dwellings in Brisbane, hitting particularly waterfront properties in low lying areas. The Queensland Government estimated that around 30,000 homes needed complete rebuilding. The experience in the aftermath of the 1974 Brisbane flood indicated no evident causation from a major flooding event to house prices and rents. However, the higher proportion of households affected in the recent floods, and the significantly larger number of houses inundated means that the predicative value of the 1974 data was unclear.[11)] Figure 3 depicts Wivenhoe Dam at 197% capacity prior to the release of water from the spillway commencing on January 8 2011.[12,13)]

3. THE FLOOD EVENT OF 2011

Tropical Cyclone Tasha crossed the coast south of Cairns – 1,600 kms north of Brisbane - on December 25 2010 heading in a southerly direction and by December 31, over 30 regional centres were flood affected. The Brisbane River peaked at 4.46m at 3:30pm on January 13. There was a heavy demand for DEM and contour information for disaster response activities. The peak height of the 1974 Brisbane flood event was 5.45m.

Figure 3: Wivenhoe Dam at 197% capacity

It is estimated that about 26,000 homes were affected when the Brisbane Flood peaked on January 13, 2011.[14)], with about 11,900 properties being fully flooded and about 14,700 partially affected. The figure of 26,000 out of 628,000 households was 4.1% of the Brisbane Major Statistical Region.[15)] Figures 4 and 5 show the aerial photographs taken before and close to the peak of the flood event over the Brisbane Metropolitan area.[16)] Figure 6 depicts flood affected towns in SE Queensland by January 14, 2011.[17)]

4. THE NEED FOR SPATIAL INFORMATION: Respond Phase During the flood event

Spatial information concerning potential inundation extent and height was required during the flood event for the coordinated planning and evacuation of neighborhoods and properties and the closure of roads. As aerial photography was acquired, the Spatial Information Group (SIG) commenced the digitising of the flood line. Using aerial photography taken at and/or shortly after the peak allowed the water or debris line to be accurately mapped. SIG staff examined the flood line property by property, which proved to be labour-intensive. The data acquisition program captured aerial phoptography over towns at times when peak record flood levels were expected. Cloud cover limited flying height and imagery capture at a rapid coverage rate and at an optimum resolution. The time lag from capture to final imagery delivery of approximately 10 days was not suited to disaster response time lines. Satellite imagery, although of general interest, was not at a spatial resolution suitable for the planning and tasking of response activities by Emergency Management Queensland.[18)]

SIG worked closely with relevant authorities to produce a flood extent map showing the one agreed flood line to avoid duplication of effort amongst agencies and to minimise the risk of competing data sets purporting to represent the 2011 floods. The flood line and mapping were subsequently used to support the Brisbane City Council's (BCC) Temporary Local Planning Instrument.[19)]

Figure 4: Brisbane River: before and after the flood event

(1) Community Financial Assistance

An inundation level just above or below the floor boards became a threshold level for providing financial assistance. Emergency assistance payments were available to those whose principal place of residence at the time of the floods was inundated with water above the level of the floor in living areas. The payments required significant resources for assessing tens of thousands of applications to ensure that the funds were paid out as quickly as possible to assist those affected. It quickly became apparent that there was no complete data set which identified all of the flood damaged residences. The Committee distributing relief funds needed to safeguard the integrity of the relief payments by only paying applications where there was sufficient information to verify the claim based on best available information at the time the application was lodged.[20)]

Figure 5: Brisbane urban area: after flood event

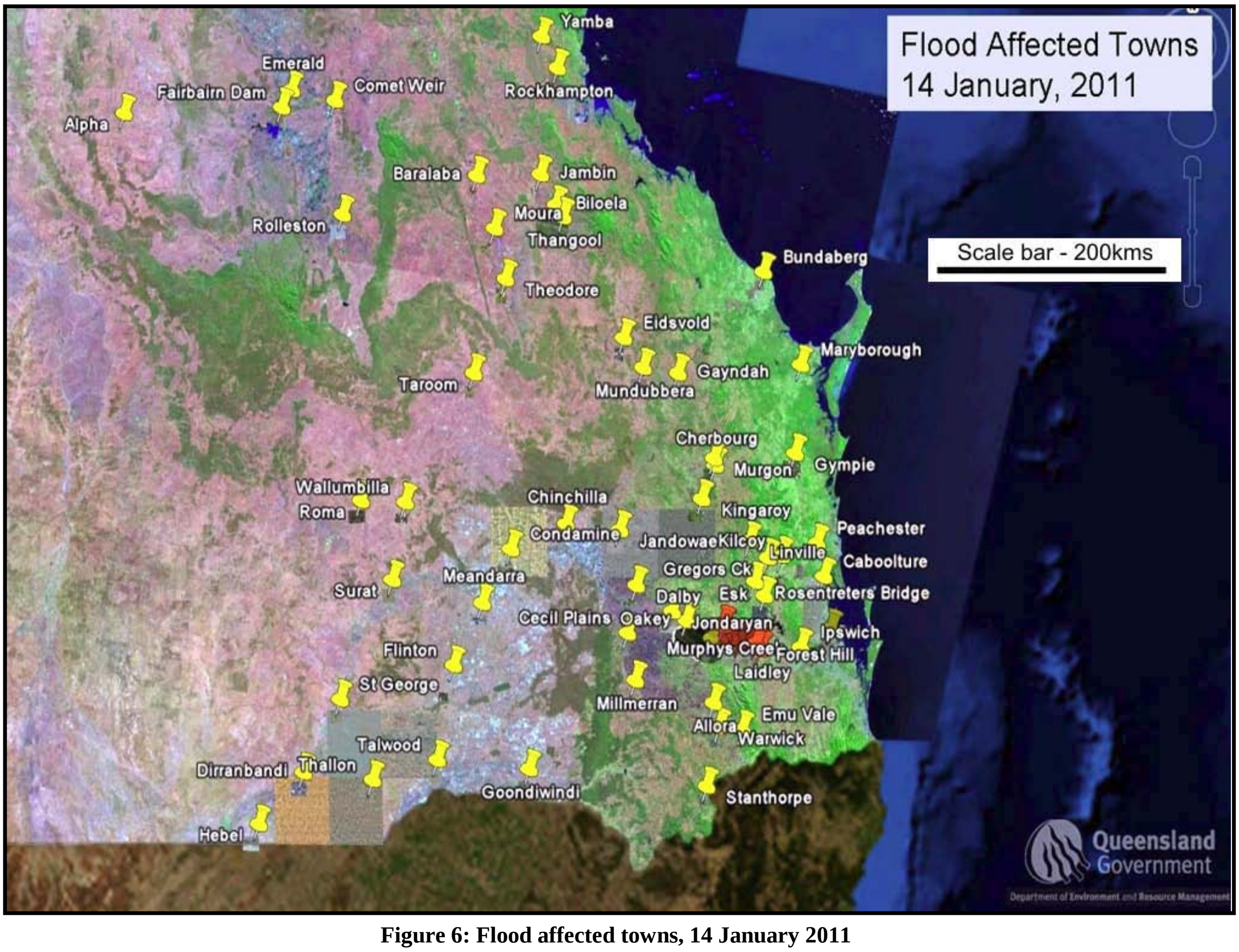


Figure 6: Flood affected towns, 14 January 2011

5. THE AFTERMATH: Recover Phase

The Queensland Government established a Commission of Inquiry to examine the 2010/2011 flood disaster that had affected 70% of the state. The Terms of Reference provided for an independent examination of events leading to the floods, all aspects of the response and the subsequent aftermath.[21)]

(1) Raising the Q100 level

More than 22,000 homes were submersed above their floor boards. Many were considered to be safe having been built above the current 100 Year Average Recurrence Interval (ARI) design storm flood level. The Commission of Enquiry suggested that significant work is required to review the region's 100 Year ARI design storm flood levels in the light of this new information.

The 100 Year ARI flood level is not necessarily the highest flood level in the region. Local authorities set a Defined Flood Event based on historical flood levels. These levels are used to inform planning and policy, in particular the level that Councils require habitable floors to be built above to provide protection against floods up to the magnitude of a Defined Flood Event. Many Councils are revising their 100 Year ARI flood levels as a result of the data gathered during the 2011 floods. In particular, Brisbane City Council announced that new homes in flood-affected areas will have to be built 800mm to 2m higher to ensure the habitable floor level in a flood-prone area is 500mm above the flood level recorded during the 2011 flood event.[22)]

(2) Surveying and Spatial Sciences Natural Disaster Response Committee

A Joint Surveying and Spatial Sciences Natural Disaster Response Committee was formed to offer the profession's assistance to the Queensland Reconstruction Authority (QRA). The committee noted a number of factors that had the potential to impact on reconstruction activities. The key factors included:

1) The post-Wivenhoe Dam Q100 line in Brisbane does not represent the 1974 flood level. In some areas the Q100 + 500mm is a regulatory line which may be exceeded by some Brisbane flood events.
2) The recent Brisbane flood event was solely a river flood with limited local creek flooding from storm water runoff and hence had a different impact to the 1974 flood.
3) During a major flood, rivers and creeks may have significant hydraulic gradient so that the flood level at one point in the watercourse can be significantly higher than the flood level further downstream.

It thus can be inferred that there can be grounds for uncertainty as to what a flood level prediction of maximum height would actually mean with respect to an individual's understanding of the impact on their property.

(3) Spatial data for individual properties

In their submission to the Queensland Floods Commission of Inquiry dated March 2011, the Queensland Surveying and Spatial Sciences Joint Natural Disaster Response Committee identified three issues that every Queensland property occupier needed to address.[23)] The issues were: 1) Is my property in a flood prone area?; 2) How high will a particular flood come?; 3) What is the likely impact of a particular flood on my property?

The submission postulated that long time (+30 years) occupiers of a property would know the answer to issues 1 and 3 due to their first-hand knowledge of past floods. However, recent occupants or those considering a purchase would not necessarily know or have access to that shared community or other corporate knowledge. Issue 2 concerns messages broadcast via the media about predicted flood heights and the general public's lack of understanding how the height expected related to their property. A possible approach is to broadcast messages providing the expected flood height at a specific geographic location. However, a member of the public is unlikely to be able to relate to the likely impact of the flood height on the property they are occupying.

The submission proposed that appropriate signs should be erected at street corners and significant dips on all roads subject to flooding. Additionally, the submission proposed that the height of the ground floor of all premises in flood prone area to be measured and required to be displayed on the premises. Further, a communication strategy should be in place that would allow an occupier to link a predicted flood height to the local information on the proposed street signs.

(4) Queensland Floods Commission of Inquiry Final Report

The Queensland Floods Commission of Inquiry (QFCI) key recommendations include:

- Government should ensure the existence and maintenance of a repository of flood related data;
- Where development is expected to occur, councils should develop maps and maintain flood flow maps and have a flood overlay map in their planning schemes;

- Councils should ensure that residents and businesses can clearly understand the impact of predicted flood levels and that the Maps be interpretable by the public;
- Make available to the public a ‘real time’ flood mapping product;
- Flood maps or data are needed which takes into account sea level rise or the storm surge impacts – fear of compensation.[24)]

In particular, at *Appendix 3: Interim Report recommendations, Chapter 4 Forecasts, warnings and information 4.13*, the QFCI report requires Councils ensure that residents and businesses can clearly understand the impact of predicted flood levels on their property by adopting one or more of the following methods:
- information on rates notices about flooding in individual properties;
- geospatial mapping, available to the public, that depicts inundation at certain river heights;
- flood markers;
- flood flag maps and floodwise property reports[25)];
- colour coded maps.[26)]

6. THE NEED FOR SPATIAL INFORMATION: Prevent Phase - During the aftermath

DERM assigned priority to completing flood lines and flood extent maps as soon as possible after spatial imagery became available. Aerial photography was acquired for 187 towns and suburbs in Queensland and flood lines produced for 115. DERM attempted to map flood lines from all aerial photography taken, but in many cases a flood line could not be discerned. This was usually due to imagery being acquired too long after the flood peak. Figure 7 depicts the debris line used in mapping the flood inundation extent in the Brisbane metropolitan area and a comparison between observed line and predicted line from BCC flood modelling.[27)]

Figure 7: Debris line used to map floodline

Information related to previous floods was used to create the Interim Floodplain area. The information included aerial photography and satellite imagery of the 2010/2011 flood event and highest recorded data from DERM gauging stations. It also included evidence of vegetation and soils typically associated with floodplains.

DERM’s expectation is that future flood occurrence to fall within the Interim Floodplain area. However, it is possible for larger floods to exceed this area. Local Authority knowledge and verification/amendment of the mapping is very important given the methodology used and noting that the mapping was not checked in the field. The QRA toolkit makes it clear that the Floodplain Mapping should be considered as Level 1 in a flood maturity mapping model, where Level 0 is a Council with no flood mapping. Level 2 would be achieved by a Council verifying and validating the mapping. This could include incorporation of higher quality (localised) data and/or amending the Floodplain Mapping Area through the application of local knowledge.

(1) Future Research and Development

Based on the experiences of the 2010-11 flood event, DERM has proposed research activities to produce datasets and models to facilitate visualization of evolving flood events, provide situational awareness and support informed decision making. The activities include:

- Development of a facility to 'layer' in flood lines and model predictions;
- Investigation of potentially varying floodline and floodplain mapping and visualisation techniques for the disparate problems of urban and rural areas;
- Investigation of the utilisation of high resolution data (Lidar) and rigorous survey and image capture techniques for the determination of first floor building levels.

Figure 9 depicts a flood height and its level in relation to first floor clearance above ground level. An insurance claim lodged by the middle house, would not be compensated to the same degree as the two houses on either side. The community's apparent lack of understanding of the difference between the definition of 'inundation' and 'flooding' in insurance policies has been the root cause of frustration and anger with the delay in settling of insurance claims. The DERM research proposes a web-based facility to allow all stakeholders with an interest in a property to visualize the predicted or actual floodline in context as shown in Figure 9.[28)]

Figure 9: Floodline and first floor ground clearance

(2) Insurance Claims and Evaluation

The settlement of insurance claims became a serious and ongoing source of frustration for both policy holders and insurance companies. Due to lack of certainty as to whether a property was covered under the terms of the insurance policy, many claims are still outstanding over twelve months after the Brisbane flood event. This state of non-closure has created on-going and widespread social problems. Stakeholders, both insured and uninsured at the time of the flood event are relying on the release of the Queensland Floods Commission of Enquiry Final Report on March 16 to provide evidence for the resolution of outstanding claims and for access to other sources for compensation of losses. Unfortunately, spurious and vexatious insurance claims have confused and delayed the settling of genuine claims.

Work undertaken at QUT produced a map of insurance claims shown in relation to the floodline for one of the worst affected suburban areas in Brisbane. The research used datasets provided by DERM and duplicated the departmental procedure for investigation of claims across the flood affected areas of Brisbane. Claims were evaluated and mapped using spatial analysis procedures against four compliance values. The ranges of compliance values were for claims: Outside floodline; Inside floodline (depth undetermined); Inside floodline (depth 0-3m); Inside floodline (depth > 3m). The depth component was a determining indicator for compliance as first floor level in the Brisbane area have traditionally been built at 2.4m clearance above ground level. This level – habitable floor level – was a criterion to determine eligibility for emergency financial assistance available from the Premier's Flood Relief Appeal.

Figure 10 depicts the map of properties for which insurance and financial assistance claim were lodged versus the mapped floodline within the research area.

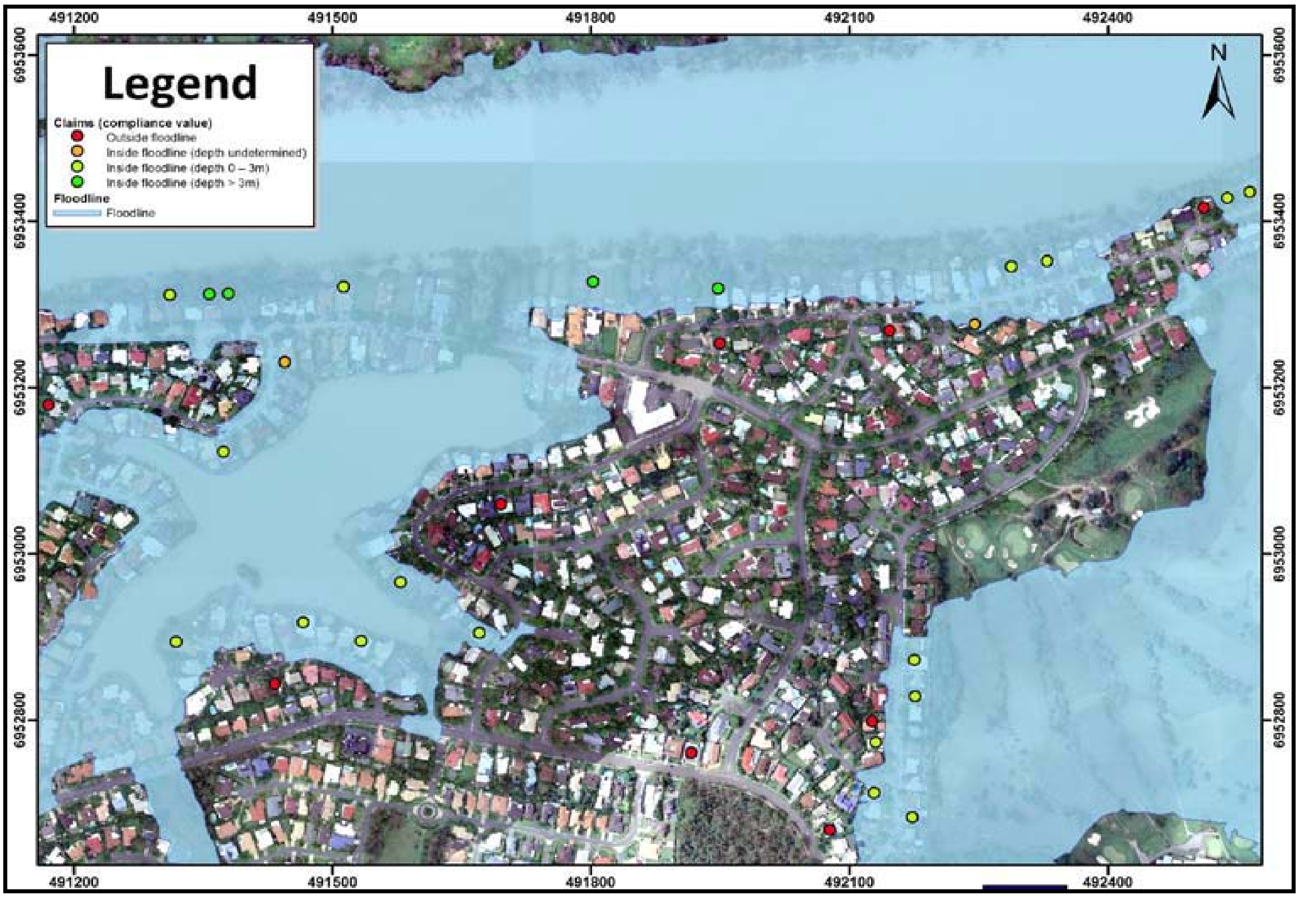


Figure 10: Claim versus floodline – Brisbane

7. CONCLUSIONS

This study has reviewed the usage and limitations of spatial information in its role as a ‘soft’ infrastructure during and in the aftermath of the Brisbane 2011 flood event. Principle amongst lessons learnt is the importance of an authoritative record of the event to serve as ‘point of truth’ in support of decision making for a coordinated and timely response by emergency management organisations for recovery, relief, insurance, reconstruction operations and in the preparation phase for future natural disaster events. A complete and timely capture of imagery is critical for flood plain mapping, catchment modeling and future inundation prediction. High resolution imagery and elevation data is important for the determination of the flood line and inundation extent and depth, particularly because of the more closed nature of the urban environment. Floor heights are central in determining the eligibility of flood affected properties for the receipt of emergency assistance and for the timely verification and settlement of insurance claims.

However, the paramount lesson learnt has been the need to, in an evolving disaster situation, make information available, publish early whilst still accepting feedback to facilitate dynamic update. The betterment of community resilience will occur if a member of the public is able to unambiguously visualise the disaster risk to their own property. Engaging the public is encouraged and the desired outcome and consequence of the proper implementation of all lessons learnt, will drive the development of community resilience based on access to specific contextual spatial information during a disaster event such as the 2011 Brisbane flood.

REFERENCES

1) Queensland Reconstruction Authority. Rebuilding a stronger, more resilient Queensland, pg.4, Available at: http://www.qldreconstruction.org.au/u/lib/cms/Resilience-doc.pdf, Accessed on March 28, 2012
2) Council of Australian Governments. National Partnership Agreement on Natural Disaster Resilience, 2009, Available at: http://www.em.gov.au/npa, Accessed on March 26, 2012.
3) Queensland Reconstruction Authority. Rebuilding a stronger, more resilient Queensland, pg.8.

4) Ibid. pg.7.
5) Attorney-General's Department, Australian Government. Natural Disaster Relief Recovery Arrangements, Available at: http://www.em.gov.au/Documents/NDRRA%20-%20Determination%202011%20-%20Version%201%20(PDF)%20-%20Web%20update.pdf, Accessed on March 27, 2012.
6) Department of Industry Science and Resources. Positioning for Growth – Spatial Information Industry Action Agenda, September 2001, pg.17, Available at: http://www.spatialbusiness.org/site/DefaultSite/filesystem/documents/SIAA_Positioning__20050606100443.pdf, Accessed on March 28, 2012.
7) *Flood modeling data*, Available at: http://www.australiangeographic.com.au/journal/brisbane-floods-did-the-dams-work.htm, Accessed on March 23, 2012.
8) Woolley, B. *SEQwater defends Wivenhoe dam flood management*, The World Today, ABC News, Available at: http://www.abc.net.au/worldtoday/content/2011/s3190309.htm, Accessed on March 22, 2012.
9) Department of Environment and Recourse Management. Historical Flood Maps, Available at: http://www.derm.qld.gov.au/museum/pdf/historical-flood-maps.pdf, Accessed on March 24, 2012.
10) WMA Water. Queensland Flood Commission of Inquiry, Brisbane River 2011 Flood Event – Flood Frequency Analysis Final Report, September 2011, Available at: http://www.floodcommission.qld.gov.au/__data/assets/file/0012/10524/Mark_Babister_WMAwater.pdf, Accessed on March 24, 2012.
11) Manager, Domestic Economy Division. Impact of the Queensland floods on house prices and rents, Treasury Executive Minute, 20 January 2011, Available at: http://www.treasury.gov.au/documents/2049/PDF/26_TEM_Impact_of_the_Queensland_Floods_on_House_Prices_and_Rents_110120.pdf, Accessed on March 25, 2012.
12) Brisbane daily photo, *Nearly at the top*, Available at: http://brisdailyphoto.blogspot.com.au/2011/02/nearly-to-top.html, Accessed on March 25, 2012.
13) Courier Mail. *Wivenhoe Dam bosses holidayed as flood crisis deepened*, Available at: http://www.couriermail.com.au/news/queensland/dam-bosses-holidayed-as-crisis-deepened/story-fnbwrsv2-1226304559601, Accessed on 22 March, 2012.
14) The ABCDiamond Forum. *Brisbane: Some facts relating to the Brisbane 2011 floods*, Available at: http://www.abcdiamond.com/forum/aus/brisbane-some-facts-relating-to-the-brisbane-2011-floods/msg145/#msg145, Accessed on February 23, 2012.
15) Courier Mail. *Flood levels are dropping in Brisbane*, Available at: http://www.couriermail.com.au/news/queensland/brisbanes-central-business-district-survived-its-first-high-tide-test-with-flood waters-failing-to-hit-predicted-levels/story-e6freoof-1225986458412, Accessed on March 1, 2012.
16) Brisbane Times. *Flood peaks in Brisbane*, Available at http://www.brisbanetimes.com.au/photogallery/environment/weather/flood-peaks-in-brisbane-20110113-19oid.html?selectedImage=0, Accessed on March 23, 2012.
17) Department of Environment and Resource Management. Queensland Floods and Tropical Cyclone Yasi – Spatial Imagery and Information, pg.38, Available at: https://datasmart.oesr.qld.gov.au/Events/datasmart.nsf/0/4BA9949A967F0B2E4A25788800124B89/$FILE/Jacoby%202011%20Natural%20Disasters%20QSIC%20pres%206%20May.pdf?openelement, Accessed on March 2, 2012.
18) Department of Environment and Resource Management. Queensland Floods and Tropical Cyclone Yasi – Spatial Imagery and Information, pg.7, 12-13.
19) Jacoby, S. Statement to Queensland Floods Commission of Inquiry, Declared on October 17, 2011, Available at: http://www.floodcommission.qld.gov.au/__data/assets/file/0012/10704/Jacoby_Steven.pdf, Accessed on March 10, 2012
20) Premier's Disaster Relief Appeal Distribution Committee Report, pg.16, Available at: http://www.premiers.qld.gov.au/publications/categories/reports/assets/premiers-disaster-relief-appeal.pdf, Accessed on March 27, 2012.
21) Queensland Floods Commission of Inquiry. Terms of Reference, Available at: http://www.floodcommission.qld.gov.au/about-the-commission/terms-of-reference, Accessed on March 28, 2012.
22) RMA Engineers, Raising the Q100 level, Available at: http://rmaeng.com.au/news/, Accessed on March 27, 2012.
23) The Queensland Surveying and Spatial Sciences Joint Natural Disaster Response Committee: A Submission to the Queensland Floods Commission of Enquiry. Queensland Floods Commission of Enquiry - Final Report, March 2012.
24) Queensland Spatial Information Council. Spatial References in Queensland Floods Commission of Inquiry Report – A summary, Available at: https://datasmart.oesr.qld.gov.au/Events/datasmart.nsf/0/CA894DA77F79CDCF4A2579C900002A78/$FILE/KEEPER_n1592314_v1_Agenda_3_Spatial_references_flood_commission_report.pdf?openelementMarch 2012, Accessed on March 28, 2012
25) Brisbane City Council Online Services. Floodwise Property Report, Available at: http://flood.brisbane.qld.gov.au/floodwise_property_report/, Accessed on March 28, 2012.
26) Queensland Floods Commission of Enquiry – Final Report, pg.635, Available at: http://www.floodcommission.qld.gov.au/publications/final-report, Accessed on March 17, 2012.
27) Department of Environment and Resource Management. Queensland Floods and Tropical Cyclone Yasi – Spatial Imagery and Information, pg.28 and 32.
28) Ibid. pg.48